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PHARMACOGNOSTIC STUDIES ON ETHNO-MEDICINAL PLANT *AERVA LANATA* (L.) JUSS

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ABSTRACT

Aerva lanata (L.) Juss belonging to family Amaranthaceae is used as the drug source by virtue of it's medicinal properties like diuretic, demulcent and anthelmintic. It is also used as painkiller in the treatment of headache and for cough, cutaneous infections, in white urine, diarrhoea, cholera, dysentery and in kidney stone. The internal structure of root, stem and leaves were studied. Root and stem shows rings of secondary vascular bundles. Calcium oxalate crystals are present in the cortex and pith region of the stem and mesophyll and midrib of leaf. The genus *Aerva lanata* is characterized by well developed, multicellular, uniseriate, unbranched trichomes which are composed of few short basal cells with yellow walls and several longer cells. Presence of small knobs and papillae on walls is characteristic feature of hair. Phytochemical analysis showed the presence of carbohydrates, proteins, amino acids, glycosides, flavonoids, alkaloids, tannins and phenolics. Medicinal significance of this plant is due to Presence of these secondary metabolites.

KEYWORDS: ***Trichomes, Headache, Diuretic, Calcium oxalate***

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INTRODUCTION

Aerva lanata (L.) Juss belonging to family Amaranthaceae is common throughout the plains in irrigated fields, gardens, hedges and shade of trees. It is small, erect, branched herb with alternate leaves and clustered spikes of white flowers (Fig.1). Various chemical constituents have been isolated from this plant. The o-acylglycosides, beta–sitosterol, dausterol, syringic acid, vanillic acid, feruloylthyramine, feruloylhomovanillylamine, narcissin and aervitrine were identified from aqueous extract of aerial parts of *Aerva lanata*[1]. Antimicrobial activity, cytotoxicity Chemical constituents, pharmacological activity and antioxidant activity of *Aerva lanata* were studied [2,3,4]. Whole plant is medicinal.[5] The root paste is rubbed on the forehead in headache[6] Root is diuretic and demulcent[7]. Inflammation of kidney is ameliorated by a decoction of roots and urination is increased hence it is used for kidney stone. It is used as painkiller in the treatment of headache and for cough.[9] Dry leaves and flowers are smoked during asthama[10] It is used as an anthelmintic, in haematemesis and diabetes and for lithiasis, also used against swellings and cutaneous infections, in white urine, diarrhoea, cholera, dysentery and in kidney stone [11, 12] Flowers useful in kidney stone and in gonorrhea [13, 14,15].

MATERIALS AND METHODS

Plants were collected and important parts like root, stem, petiole and leaves were preserved in 4% formalin. The ethno-medicinal information about the plant was obtained through interrogation and literature survey followed by thin section study of individual plant parts. All the sections were stained in safranin and dehydrated following the usual method[16] of and mounted in D.P.X. for microscopic observation. To study the stomatal complex and hairs from leaves, epidermal peelings of fresh leaves were directly done mechanically by forcep. The peels were stained with safranin by mounting in glycerine. For phytochemical analysis[17], the plant parts root. Stem, leaves and flowers were dried in a shed under normal environmental conditions for about one week. These dried parts were broken into small pieces with the help of cutter and grinded to coarse powder. Coarsely grinded plant parts were extracted in Soxhlet apparatus successively with solvents such as acetone, benzene, chloroform, ethyl alcohol, petroleum ether and distilled water. The extracts obtained were concentrated and dried. The plant extract was subjected to chemical tests for the presence of phytochemical classes like carbohydrates, proteins, amino acids, fats and oils, steroids, glycosides, alkaloids, tannins and phenolics.

OBSERVATIONS AND RESULTS

Figure 1
Aerva lanata (L) Juss. Habit

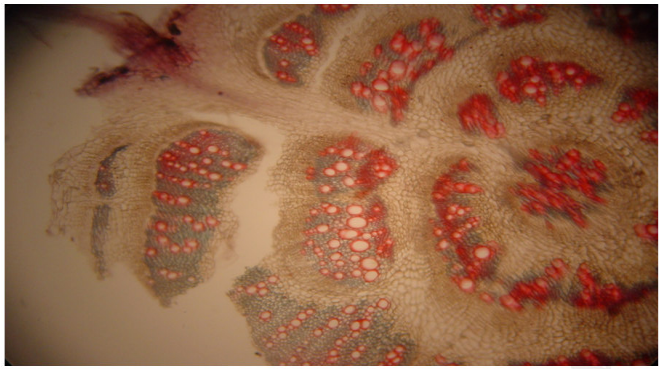

Figure 2
T.S. of Root (sector magnified) showing sec growth x 160

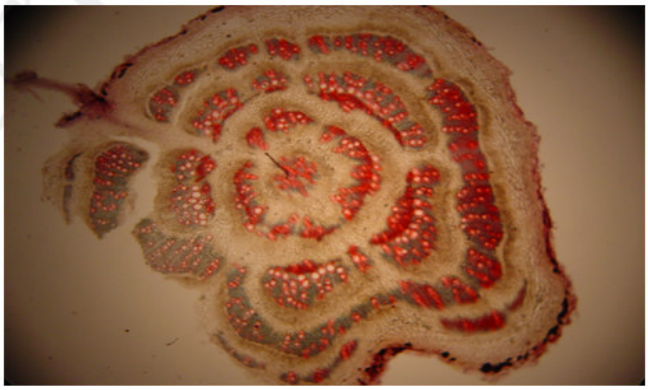

Figure 3
T.S. of Root (secondary growth) showing periderm, three rings of secondary vascular bundles and primary xylem and primary phloem in the centre x 80

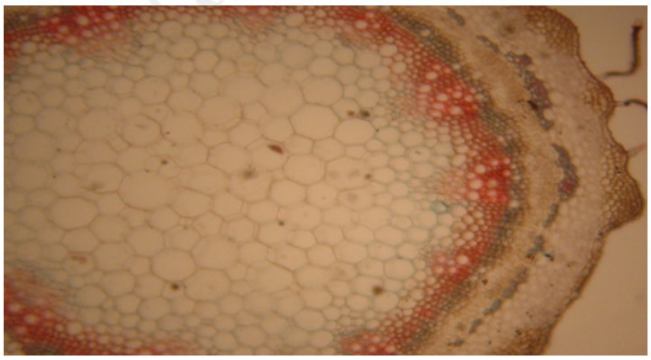

Figure 4
T.S. of stem (sector magnified) showing multicellular trichomes and pith cells containing calcium oxalate crystal sx 640

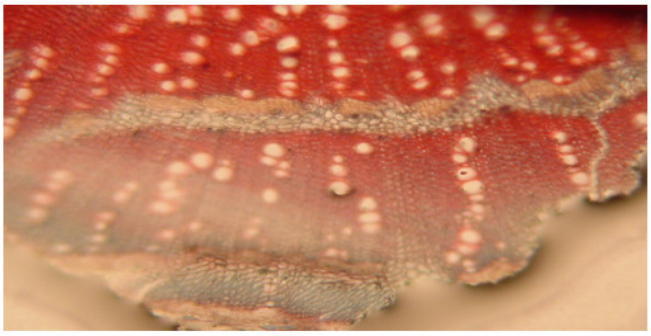

Figure 5
T.S. of stem showing secondary growth with 2 rings of vascular tissue x 640

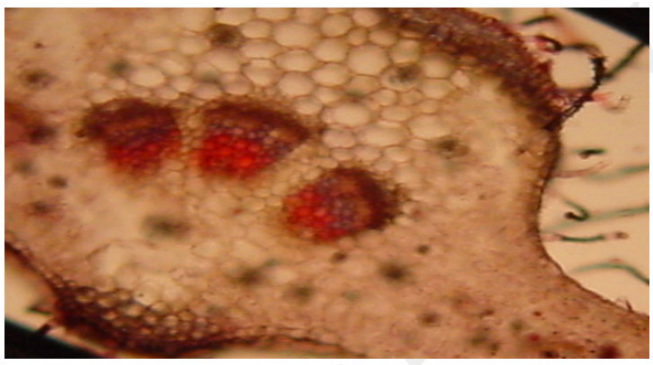

Figure 6
T.S. of midrib showing three vascular bundles and calcium oxalate crystals x 640

Plate – 3

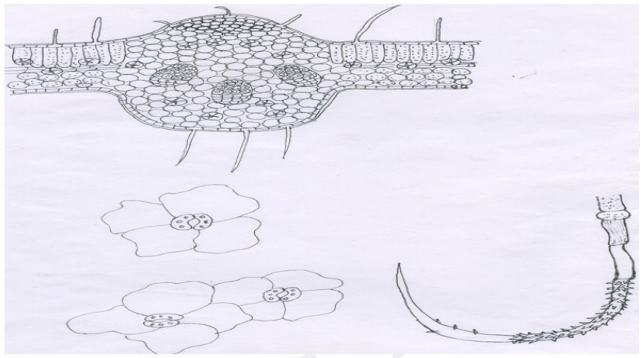

Figure 7
T.S. of leaf showing stomata and trichomes

T. S. Root (Fig. 2 and 3) - Outline circular. Epidermis is single layered, cells parenchymatous, rectangular or oval, compactly arranged without intercellular spaces, measuring about 24 x 20 μm in size. Periderm is 6 to 7 layered, cells rectangular, parenchymatous, compactly arranged, measuring about 22 x 13 μm in size. Cortex is multilayered, (5 to 6 layers), cells parenchymatous, oval, thin walled enclosing small intercellular spaces, measuring about 40 x 16 μm in size. Vascular cylinder consists of 3 rings of secondary vascular bundles. Secondary phloem is present outside to each secondary vascular bundle. In the centre primary phloem is scanty. Secondary phloem is compactly arranged and thin walled appearing rectangular in outline, measuring about 15 x 15 μm in size. Secondary xylem consists of xylem vessels arranged in radial rows, circular in outline, measuring about 31 x 34 μm in size. Primary xylem present in centre and primary phloem in form of patches. Secondary Vascular bundles are separated from each other by parenchymatous ground tissue. Secondary vascular bundles are traversed by broad parenchymatous medullary rays. Secondary growth is abnormal. T.S. Stem (Fig. 4 and 5) - Outline wavy, with small ridges. Trichomes are many, multicellular, unbranched uniseriate, measuring about 313 x 9 μm in size. Composed of a few short basal cells with yellow walls and several longer cells of which the terminal one radial rows, circular in outline measuring about 18 x 16 μm in size. Pith is wide, homogeneous, cells parenchymatous, oval, thin walled, enclosing small intercellular spaces, measuring about 52 x 49 μm in size. Some pith cells contain calcium oxalate crystals. Secondary growth is abnormal. Many rings of secondary xylem and secondary phloem are present. Secondary vascular tissue is traversed by parenchymatous medullary rays. Leaf (Fig. 7), surface view fom epidermal cells characteristic hairs arise. Hairs as in case of stem. Epidermal cells are parenchymatous, polygonal, thin walled, compactly arranged without intercellular spaces, measuring about 53 x 33 μm in size. End walls and lateral walls are straight, Stomatal complex - Leaf is amphistomatic. Stomata are 2 to 4 cell apart, anisocytic. Guard cells measuring about 32 x 8 μm in size. Pore elliptic, measuring about 10 x 4 μm in size. T. S. Leaf - Trichomes are as in case of stem, is pointed. The characteristic features presented by the trichomes are (a) The presence of numerous small knobs on the longitudinal walls of the longer cells, these knobs are not solid but constitute papillose protuberances of the wall of the hair (b) The transverse walls in the upper portion of the hair is not plane, the margin being produced into papillae so that the cells of the hair become firmly dovetailed with one another. Cuticle is thick, and continuous. Epidermis is single layered, cells parenchymatous rectangular, compactly arranged without intercellular spaces, measuring about 17 x 11 μm in size. Outer cortex collenchymatous, inner cortex parenchymatous. Collenchymatous cortex is few layered, present below ridges. Cells thick walled, compactly arranged without intercellular spaces, measuring about 23 x 21 μm in size. Some cells contain calcium oxalate crystals. Inner cortex is multilayered, cells parenchymatous, oval, thin walled, isodiametric enclosing small intercellular spaces, measuring about 23 x 21 μm in size. Endodermis is indistinct. Pericycle multilayered, cells parenchymatous containing patches of sclerenchyma. Primary vascular bundles are conjoint, collateral and open. Secondary phloem in the form of outer continuous ring. It is compactly arranged, rectangular or oval in outline, measuring about 16 x 8 μm in size. Secondary xylem also present in the form of continuous ring. Vessels arranged in measuring about 600 x 14 μm in size. Cuticle is thick, continuous. Epidermis is single layered, cells parenchymatous, oval, compactly arranged without intercellular spaces, measuring about 22 x 28 μm in size. Mesophyll is differentiated into palisade and spongy parenchyma within lamina. Below upper epidermis palisade is single layered. Cells of palisade parenchyma are elongated, columner, compactly arranged with their long axis at right angle to the leaf surface, measuring about 60 x 19 μm in size. Above lower epidermis 2 to 3 layers of spongy parenchyma are present. Cells parenchymatous, oval, thin walled, enclosing small intercellular spaces, measuring about 22 x 18 μm in size. Spongy parenchyma cells show calcium oxalate crystals. In midrib region (Fig. 6) mesophyll is not differentiated into palisade and spongy tissue. Parenchyma cells are present. Below upper epidermis collenchymatous patch is present. Cells thick

walled compactly arranged without intercellular spaces. Parenchyma cells in the midrib are large, oval, thin walled enclosing small intercellular spaces, measuring about 64 x 61 μm in size. Some cells contain crystals of oxalate of lime. Lamina is traversed by small vascular bundles of veins. In the midrib 3 vascular bundles are present towards the lower side in the form of an arc. Each vascular bundle is conjoint, collateral and closed. Xylem towards upper side and phloem towards lower side. Leaf contains group of crystals of oxalate of lime.

Table 1

Preliminary Phytochemical Investigations of *Aerva lanata* (L.) Juss

Sr.No	Test performed	Observation	Inference
1	**CARBOHYDRATES**		
a	**Molisch test -** To the test tube, few drop of Molisch's reagent was added (Alcholic α- Napthol). 2ml of conc. Sulphuric acid was added slowly form the side of the test tube	Violet ring is formed at junction of two liquids	Carbohydrate present
b	**Fehling's test** 1ml Fehling's A and 1ml Fehling's B was mixed and boiled for 1 min. To this solution was added equal volume of test solution. And boiled for 5-10 min	First yellow , then brick red ppt is observed	Reducing sugars present
c	**Benedict's test** Equal volume of Benedict's reagent and test solution was mixed in the test tube and heated to boiling water bath for 5 min	Sol appeared green yellow or red	Reducing sugars present
d	**Barford's Test** Test solution was heated with Barford's reagent on water bath.	Red ppt is obtained	Monosaccharide present
e	**Aniline acetate test** - Test solution was boiled in test tube. Filter paper soaked in aniline acetate was held in the vapour	Filter paper did not turned pink	Pentose sugars absent
f	**Cobalt- Chloride test** 3ml test solution was mixed with 2ml cobalt chloride. Boiled and cooled. Few drops of NaOH solution were added.	Sol appeared greenish blue and pink	Glucose and fructose present
g	**Iodine test -** 3 ml test solution and few drops of dilute Idoine Solution was mixed	No color	Starch absent
2	**PROTEINS**		
a	**Heat test** The test solution was heated in boiling water bath	Coagulation did not occurred	Protein absent
b	**Biuret test** Test solution was treated with biuret reagent (40% sodium hydroxide and dilute copper sulphate solution)	Violet or pink color	Protein present
3	**AMINO ACIDS**		
a	**Million's test** Test solution was treated with Million's reagent and heated on water bath	Brick red ppt	Amino acid present
b	**Ninhydrin test** Test solution with Ninhydrin reagent was boiled	Purple or Bluish colour	Amino acid present
4	**FATS AND OILS** **FILTER PAPER TEST**	No change	Fats and oils absent
5	**GLYCOSIDES**		
a	**General test** 200mg of drug with 5ml of dilute sulphuric acid was extracted by warming on a water bath, filtered and neutralized the acid extract with 5% solution of sodium hydroxide. 0.1 ml of fehlings solution A and B was added until it became alkaline (Test pH - Paper) and heated on water bath for 2min	Formation of Red ppt.	General test for glycoside Present
A	**Test for Anthraquinone Glycosides**		
a	**Modified Borntrager's test** 200 mg of test material was boiled with 2ml of sulfuric acid and treated with 2ml of 5% aqueous ferric chloride solution (freshly prepared) for 5min. It was shaked with equal volume of chloroform .lower layer from chloroform was separated and shaked it with dilute. Ammonia (half of volume of chloroform).	Ammonical layer showed pink to red color	Anthraquinone glycoside present
B	**Test for cardiac glycosides** **i] Legal's test** Test solution was treated with pyridine made alkaline with sodium nitorprusside	Pink to red color	Cardiac glycosides present
C	**Test for saponin glycosides** 2 ml of solution of drug in water was placed in test tube and shaked	Persistant foam formed	Saponin glycosides present
	Test for flavonoid glycosides		
a	**Shinoda test -** Test solution was treated with fragment of magnesium ribbon and cone. HCL was added.	Appearance of Pink color	Flavonoids present
6	**ALKALOIDS**		
a]	**Dragendorffs test-** Test solution was treated with Dragendorffs reagent (potassium bismuth iodide)	Orange brown ppt	Alkaloids present
b]	**Mayer's test** Test solution was treated with Mayer's reagent (Potassium mercuric iodide)	Cream colored ppt occurred	Alkaloids present
7	**Tannins and phenolics** a) **Ferric chloride test** Test solution was treated with few drops of 5% ferric chloride solution	No color	Hydrolysable Tannins absent
	b) To the test solution few drops of potassium dichromate solution was added	No ppt	Tannins and phenolic compound absent

DISCUSSION

The genus *Aerva lanata* (L.) Juss is characterized by well developed, multicellular, uniseriate, unbranched trichomes which are composed of few short basal cells with yellow walls and several longer cells of which the terminal one is pointed. The characteristic features presented by the trichomes are (a) The presence of numerous small knobs on the longitudinal walls of the longer cells, which are not solid but constitute papillose protuberances of the wall of the hair. (b) The transverse walls in the upper portion of the hair are not plane and the margin is produced into papillae (Fig. 7). Cortex, pith, midrib and mesophyll region of leaf is infested with raphides, composed of calcium oxalate crystals (Fig. 6). Anatomical characters are useful in identification o d rug. *Aerva lanata* is the plant used as the drug source, consisting of stomata, trichomes, calcium oxalate crystals, fibres, vessels and glycosides. Therapeutic use of this plant is due to secondary metabolites glycosides. Phytochemical analysis of this plant showed the presence of carbohydrates, reducing sugar, proteins, amino acids, glycosides, alkaloids, tannins and phenolics (Table 1). Therapeutic use of this plant due to presence of these metabolites.

CONFLICT OF INTEREST

Conflict of interest declared None.

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